CHARTA LEARNING · LESSON NOTES

Fund Management

FRM Part I

1 A story: one basket, many slices

- Many investors pool money into one basket of assets
- A manager runs it; each investor owns a slice
- Price a slice: basket value, or what buyers pay?
- The answer depends on how people enter and leave

IN THE LESSON

- Imagine one hundred friends who each want to own shares, but none has enough money to buy a wide mix.
- So they pool their cash in one basket and hire a manager to run it.
- Each friend owns a slice of the basket.
- That is a fund.
- The first question is how a slice should be priced.
- One answer is the value of the basket divided by the number of slices.
- The other is whatever the next buyer will pay.
- Which answer applies depends on how people get in and out.
- Mutual funds, closed-end funds and exchange-traded funds differ exactly there.
- Hedge funds are also pooled baskets, but they play by different rules.

2 Net asset value per share

NAV per share = (Assets − Liabilities) ÷ Shares outstanding

Assets at market value	Holdings at closing market prices
Liabilities	Accrued fees, unsettled purchases
Shares outstanding	Slices owned by investors
NAV per share	Value of one slice

IN THE LESSON

- The basket value per slice has a name: net asset value, or N A V.
- Start with the assets the fund holds, each marked to market, which means valued at current market prices at the close of the day.
- Subtract the liabilities, such as accrued fees owed to the manager and money owed for securities bought but not yet settled.
- What is left belongs to the owners.
- Divide by the number of shares outstanding and you have the N A V per share.
- Everything in this lesson about price starts here.
- The question for each vehicle is always the same: is the price equal to N A V, or does something else set it, and if so, what keeps it close?

3 Example 1: computing NAV

Illustration: a fund with 25 million shares

Assets at close	stocks marked to market	**$520m**
Liabilities	accrued fees, unsettled buys	**$20m**
Net assets	520 − 20	**$500m**
NAV per share	$500m ÷ 25m shares	**$20.00**

IN THE LESSON

- Let's use made-up numbers.
- At the close, the fund's holdings, marked to market, are worth five hundred and twenty million dollars.
- That is the first row.
- Next come the liabilities: accrued fees and money owed for purchases not yet settled, twenty million dollars.
- Net assets are five hundred and twenty minus twenty, which is five hundred million dollars.
- Finally divide by the shares.
- The fund has twenty-five million shares outstanding, so five hundred million divided by twenty-five million gives a net asset value of twenty dollars per share.
- Notice what we did not use: any opinion about what the shares are worth to buyers.
- N A V is arithmetic on the balance sheet.

4 Three vehicles, three links to NAV

How each vehicle ties price to NAV

Vehicle	Price and shares
Open-end fund	Next NAV, with the fund
Closed-end fund	Market price; can be off NAV
ETF	Market price; kept near NAV
Share count	Open-end floats; closed fixed

IN THE LESSON

- Here is the map for the first outcome.
- An open-end mutual fund deals directly with the fund.
- You buy new shares from it and sell shares back to it, at the N A V struck after the close, so the share count floats up and down with flows.
- A closed-end fund raises a fixed amount at launch, then its shares trade on an exchange between investors.
- The fund does not redeem, so its price is set by supply and demand and can differ from N A V.
- An exchange-traded fund also trades on an exchange, but special large traders can create and redeem shares, and that keeps its price near N A V.
- The mechanism that links price to N A V is what you must name for each.

5 The closed-end fund

- Fixed number of shares sold once at launch
- Investors trade shares with each other on an exchange
- Price set by supply and demand, not by the fund
- Premium or discount to NAV; nothing closes the gap

IN THE LESSON

- Take the closed-end fund first.
- It sells a set number of shares in an initial offering, invests the money, and then closes its doors.
- If you want in, you buy shares from another investor on the exchange.
- If you want out, you sell to another investor.
- The fund itself never buys shares back at N A V.
- So the price is whatever the crowd will pay.
- If investors love the manager, the shares can trade above N A V, which is a premium.
- If they are gloomy or the fund is hard to understand, the shares can trade below N A V, which is a discount.
- Nothing forces the gap to close, because there is no redemption to bring price back.

6 Example 2: a discount to NAV

Illustration: NAV $20.00 per share

NAV per share	from the fund's books	**$20.00**
Market price	set by buyers and sellers	**$17.60**
Gap to NAV	17.60 − 20.00	**−$2.40**
Discount	−2.40 ÷ 20.00	**−12%**
If price were $22.00	(22.00 − 20.00) ÷ 20.00	**+10% premium**

IN THE LESSON

- Suppose a closed-end fund has a net asset value of twenty dollars a share, from the balance sheet.
- That is the first row.
- The shares trade on the exchange at seventeen dollars and sixty cents, set by buyers and sellers.
- The gap is seventeen sixty minus twenty, which is minus two dollars and forty cents.
- Divide the gap by N A V: minus two forty over twenty is minus twelve per cent, a twelve per cent discount.
- Had the price been twenty-two dollars, the gap over N A V would be two over twenty, a ten per cent premium.
- A discount means you buy a dollar of assets for less than a dollar, but the fund will not redeem to prove it.

7 The exchange-traded fund

- Trades on an exchange all day, like a stock
- Authorized participants create and redeem large blocks
- Usually in kind, against the underlying basket
- Arbitrage pulls price back toward NAV

IN THE LESSON

- An exchange-traded fund, or E T F, looks like a closed-end fund because its shares trade on an exchange all day.
- The difference is a creation and redemption process.
- Large institutions called authorized participants can hand the fund a block of the underlying securities, usually in kind, and receive a block of new E T F shares.
- They can also hand back E T F shares and receive the securities.
- Now suppose the E T F price drifts above the value of its basket.
- Participants buy the basket, create E T F shares and sell them, earning the gap, and their selling pushes the price down.
- A price below N A V works in reverse.
- That arbitrage keeps price close to N A V.

8 Example 3: the arbitrage in action

Illustration: per share, ignoring trading costs

ETF price on exchange	what buyers are paying	**$20.40**
NAV of the basket	cost of the stocks inside	**$20.00**
Gap	20.40 − 20.00	**$0.40**
Participant's move	buy basket, create, sell ETF	**locks in 0.40**
Effect	added supply cuts the price	**toward NAV**

IN THE LESSON

- Here is the mechanism in numbers per share, ignoring costs.
- The E T F trades on the exchange at twenty dollars and forty cents.
- The basket of stocks inside it is worth, at N A V, twenty dollars.
- The gap is forty cents.
- An authorized participant buys the basket for twenty dollars, hands it to the fund, receives E T F shares and sells them at twenty forty.
- That locks in forty cents.
- The effect is more supply of E T F shares, which pushes the price down toward N A V.
- If the price were instead below N A V, the participant would buy cheap shares, redeem them for the basket, and sell the basket.
- This is why an E T F is not a closed-end fund.

9 Open-end fund: the price is the next NAV

- No market price: you trade with the fund itself
- Order today is filled at the next NAV after the close
- Front-end load cuts cash in; exit fee cuts cash out
- Costs of raising cash fall on those who stay
- No premium or discount, unlike a closed-end fund

IN THE LESSON

- Now the second outcome.
- An open-end fund has no market price at all.
- You deal with the fund itself, at its net asset value, adjusted for loads and other fund-specific mechanisms.
- An order placed during the day is filled at the N A V struck after the close.
- This is called forward pricing, and it means you do not know your price when you place the order.
- A front-end load is deducted from the cash you pay in, and a redemption fee or back-end load from what you are paid out.
- Because redeemers are paid at N A V, the trading costs of raising their cash fall on the holders who stay.
- So there is no premium or discount: the price is the next N A V, adjusted.

10 Example 4: a front-end load

Illustration: 5% front-end load, next NAV $20.00

Cash paid in	what leaves your account	**$10,000**
Front-end load	5% × 10,000	**−$500**
Invested at NAV	10,000 − 500	**$9,500**
Shares received	9,500 ÷ 20.00	**475**

IN THE LESSON

- Suppose you send ten thousand dollars to an open-end fund that charges a five per cent front-end load.
- That is the cash leaving your account.
- The load is five per cent of ten thousand, which is five hundred dollars, taken out first.
- What is invested at N A V is ten thousand minus five hundred, nine thousand five hundred dollars.
- If the next N A V struck after the close turns out to be twenty dollars a share, you receive nine thousand five hundred divided by twenty, which is four hundred and seventy-five shares.
- Notice the order: you chose the amount before you knew the price, and the load meant you never bought ten thousand dollars of assets, only nine thousand five hundred.

11 Example 5: a distribution lowers NAV

Illustration: 100 shares, $1.00 paid per share

Wealth before	100 × 20.00	**$2,000**
Distribution received	100 × 1.00 in cash	**$100**
NAV after payout	20.00 − 1.00	**$19.00**
Shares now worth	100 × 19.00	**$1,900**
Wealth after	1,900 + 100 cash	**$2,000**

IN THE LESSON

- A fund can also pay out income and gains.
- Suppose you own one hundred shares and the N A V is twenty dollars, so your wealth is two thousand dollars.
- The fund pays a distribution of one dollar a share, so you receive one hundred dollars in cash.
- The N A V drops by exactly the amount paid, from twenty dollars to nineteen dollars.
- Your hundred shares are now worth one hundred times nineteen, which is nineteen hundred dollars.
- Add the hundred dollars of cash and your wealth is two thousand dollars again.
- Before tax, a distribution changes the form of your wealth, not the amount, which is why a falling N A V after a payout is not a loss.

12 Late trading: breaking the cut-off

- Order taken after the cut-off, filled at that day's NAV
- Trader uses news released after the close
- Gain comes out of the other holders
- Illegal: it breaks forward pricing

IN THE LESSON

- Now the third outcome: two behaviors that hurt the long-term holders of an open-end fund.
- The first is late trading.
- The rule of forward pricing is that orders must arrive before a cut-off, typically the four p m market close, to get that day's N A V.
- Late trading means an order is accepted after the cut-off but still filled at that day's N A V.
- Why would anyone want that?
- Because news may have arrived after the close.
- If good news is out, the trader buys at the old, too-low price, then sells later at the higher one.
- The gain is risk-free, and it comes out of the other holders.
- It is illegal because it breaks forward pricing.

13 Market timing: exploiting stale prices

- Frequent in-and-out trading against stale NAVs
- Fund holds Asian shares; prices hours old at the US NAV
- Timer buys cheap, or sells dear, then repeats
- Not illegal in itself, but it moves value to the timer

IN THE LESSON

- The second behavior is market timing, which is frequent in-and-out trading that exploits stale prices.
- Take a fund that holds Asian shares.
- Those markets closed many hours before the American N A V is struck, so the prices in the N A V are old.
- If the American market has moved sharply since then, the Asian shares will probably follow the next day.
- A timer buys cheap against the stale N A V when the move is up, or sells dear when it is down, and repeats.
- Unlike late trading, this is not illegal in itself.
- But value moves from buy-and-hold investors to the timer, and the constant trading adds costs that the long-term holders also bear.

14 Example 6: a market timer's gain

Illustration: Asian-share fund, US market has rallied

Stale NAV at the US close	Asian prices hours old	**$10.00**
Fair NAV after the rally	Asia expected up 2%	**$10.20**
Timer buys $100,000	100,000 ÷ 10.00	**10,000 shares**
Next-day value	10,000 × 10.20	**$102,000**
Gain taken from holders	102,000 − 100,000	**$2,000**

IN THE LESSON

- Take a fund of Asian shares.
- The N A V struck at the American close uses stale Asian prices and is ten dollars.
- After a strong American rally the fair value of the same holdings, as Asia is expected to rise about two per cent, is ten dollars and twenty cents.
- The timer puts in one hundred thousand dollars and receives one hundred thousand divided by ten, ten thousand shares.
- The next day the N A V is ten twenty, so those shares are worth ten thousand times ten twenty, one hundred and two thousand dollars.
- The timer can sell and walk away with two thousand dollars.
- That two thousand dollars came out of the buy-and-hold investors who stayed.

15 Two behaviors and the defenses

Late trading breaks the cut-off; timing exploits stale prices

Item	What it is
Late trading	Late, at old NAV; illegal
Market timing	In-and-out on stale NAV
Fair value pricing	Reprices stale holdings
Redemption fees	Charge short holding periods
Switching limits	Cap in-and-out moves

IN THE LESSON

- Let's set the two behaviors side by side, because this is the distinction to remember.
- Late trading breaks the cut-off: the order arrives too late but gets the old price, and it is illegal.
- Market timing exploits stale prices: every order is on time, but the price it receives is out of date, and it is not illegal in itself.
- Funds fight back in three ways.
- Fair value pricing replaces stale quotes on holdings with an estimate of what they are worth now, which shrinks the timer's edge.
- Redemption fees on short holding periods make quick in-and-out trading costly.
- And limits on switching cap how often investors can move in and out.

16 Hedge funds versus mutual funds

Mutual fund | Hedge fund

Feature	Mutual | Hedge
Investors	Public | Private placement
Rules	Heavy | Light
Leverage and shorts	Limited | Free to use
Redemption	Daily | Lock-ups, gates
Fees	Expense | Plus incentive

IN THE LESSON

- Now the fourth outcome.
- Hedge funds are pooled vehicles like mutual funds, but they differ in regulation, investors and freedom.
- Mutual funds are sold to the public, are heavily regulated, must disclose holdings and fees, and face limits on leverage, short selling and derivatives.
- Hedge funds are sold by private placement to wealthy or institutional investors, with much lighter regulation and disclosure.
- They can use leverage, short positions, derivatives and illiquid assets.
- Mutual funds usually redeem daily at N A V, whereas hedge funds restrict liquidity with lock-up periods, notice periods and gates.
- Fees differ too: mutual funds charge an expense ratio on assets, hedge funds add an incentive fee on profits.

17 Why the differences matter

- Lock-ups and gates let funds hold illiquid positions
- Hedge funds target absolute returns
- Mutual funds are judged against a benchmark
- Lightly regulated, not entirely unregulated

IN THE LESSON

- Why do the differences matter?
- Because lock-ups, notice periods and gates let a hedge fund hold positions that could not survive daily redemptions.
- If investors can leave tomorrow, the manager cannot hold an illiquid asset for years.
- If they cannot, the manager can.
- The goals differ as well.
- Hedge funds target absolute returns, a positive result whatever the market does, while mutual funds are usually judged against a benchmark.
- And here is the common error: assuming that hedge funds are entirely unregulated.
- They are lightly regulated and lightly disclosed, which is different.
- Their managers and their selling still fall under rules, even though holdings and fees are not shown to the public as they are for a mutual fund.

18 What a hedge fund investment returns

Net return = (Gross − Mgmt fee) × (1 − Incentive rate)

Gross return	Return before any fee
Management fee	Charged on assets, always
Incentive rate	Share of profit, if positive
Net return	What the investor keeps

IN THE LESSON

- Now the fifth outcome.
- A typical hedge fund charges a management fee on assets, say two per cent, and an incentive fee on profits, say twenty per cent.
- That is the famous two and twenty.
- The investor's return is the gross return, less the management fee, less the incentive fee on what remains.
- When the return after the management fee is positive, and with no hurdle, the net return equals the gross return minus the management fee, all multiplied by one minus the incentive rate.
- In a bad year the investor still pays the management fee, but no incentive fee.

19 Example 7: two and twenty

Illustration: 2% management fee, 20% incentive fee, no hurdle

Gross return, good year	before any fee	**15%**
After management fee	15% − 2%	**13%**
Incentive fee	20% × 13%	**2.6%**
Net return to investor	13% − 2.6%	**10.4%**
Poor year: gross 1%	1% − 2%; no incentive fee	**−1%**

IN THE LESSON

- Take a good year first.
- The fund earns a gross return of fifteen per cent before any fee.
- After the management fee of two per cent, that is fifteen minus two, thirteen per cent.
- The incentive fee is twenty per cent of the thirteen, which is two point six per cent.
- The investor keeps thirteen minus two point six, ten point four per cent.
- Check with the formula: thirteen times eighty per cent is ten point four.
- Now a poor year, with a gross return of one per cent.
- After the management fee of two per cent that is minus one per cent, there is no profit, so no incentive fee, and the investor's net return is minus one per cent.

20 Example 8: hard and soft hurdles

Illustration: gross 15%, 2% fee, 20% incentive, 5% hurdle after fee

After management fee	15% − 2%	**13%**
Hard hurdle: fee base	13% − 5% hurdle	**8%**
Hard hurdle: fee	20% × 8%	**1.6%**
Hard hurdle: net	13% − 1.6%	**11.4%**
Soft hurdle: net	13% − 20% × 13%	**10.4%**

IN THE LESSON

- A hurdle rate means the incentive fee is charged only if the return beats a threshold.
- Keep the same fund, a gross return of fifteen per cent, and add a hurdle of five per cent, measured here after the management fee.
- After that fee the return is thirteen per cent.
- With a hard hurdle, the fee applies only to the return above the hurdle, thirteen minus five, which is eight per cent.
- Twenty per cent of eight is one point six per cent, so the net return is thirteen minus one point six, eleven point four per cent.
- With a soft hurdle, once it is cleared, the fee applies to the whole profit.
- Twenty per cent of thirteen is two point six, so the net return is ten point four per cent.

21 Example 9: the high-water mark

Illustration: start $100, 20% incentive fee, no other fees

Year 1: +20%	120, fee 20% × 20 = 4	**$116.00**
Year 2: −10%	116 × 0.90	**$104.40**
Year 3: +10%	104.40 × 1.10	**$114.84**
Fee in year 3	below the $116 mark	**$0**
Without a mark	20% × 10.44	**$2.09**

IN THE LESSON

- A high-water mark means the incentive fee is charged only on gains above the highest previous N A V, so losses must be recovered first.
- To keep it simple, ignore the management fee.
- Start at one hundred dollars.
- In year one the fund gains twenty per cent to one hundred and twenty, and the incentive fee is twenty per cent of twenty, four dollars, leaving one hundred and sixteen.
- That is the new mark.
- In year two it falls ten per cent to one hundred and four dollars and forty cents.
- In year three it gains ten per cent to one hundred and fourteen eighty-four, still below the mark, so no fee is due.
- Without a mark, the manager would charge two dollars and nine cents.

22 Example 10: the clawback

Illustration: 20% incentive fee, $100 start, fee paid outside the fund

Year 1 profit	100 to 120; fee 20% × 20	**$4 paid**
Year 2 loss	120 back to 100	**−$20**
Profit over two years	100 − 100	**$0**
Fee actually earned	20% × 0	**$0**
Clawback	manager returns the fee	**$4**

IN THE LESSON

- A clawback requires the manager to return earlier incentive fees if later losses mean the fee was not earned over the whole period.
- Start again at one hundred dollars.
- In year one the fund gains to one hundred and twenty, a profit of twenty, and the manager is paid an incentive fee of twenty per cent of twenty, four dollars.
- In year two the fund loses twenty dollars and is back at one hundred.
- Over the two years the profit is one hundred minus one hundred, which is zero.
- The fee actually earned is twenty per cent of zero, which is zero.
- So the manager must give back the four dollars.
- Without a clawback, the investor would have paid for a result they never got.

23 The risks hedge funds run

- Leverage: borrowing magnifies losses
- Liquidity: cannot sell quickly without a big price drop
- Model and counterparty: bad formula, partner fails
- Operational: errors, fraud, failed systems
- Tail: rare, extreme losses

IN THE LESSON

- Now the sixth outcome, in two parts: the risks and the strategies.
- Hedge funds run six main risks, and the board puts model and counterparty on one line.
- Leverage risk: borrowing magnifies losses as well as gains.
- Liquidity risk: positions that cannot be sold quickly without a big price drop, which matters when investors want their money back.
- Model risk: the formulas behind a trade turn out to be wrong.
- Counterparty risk: a trading partner fails to pay.
- Operational risk: errors, fraud or failed systems.
- And tail risk: rare, extreme losses far larger than the usual swings.
- Different strategies are dominated by different risks, so for each strategy the task is to match the position to its characteristic risk.

24 Strategies, part one

Strategy, position and main risk

Strategy	Position and main risk
Managed futures	Futures trends; reversals
Global macro	Leveraged views; wrong call
Emerging markets	Mostly long; sovereign, FX
Fixed income arbitrage	Levered spreads; widening
Convertible arbitrage	Bond vs stock; hedge breaks

IN THE LESSON

- Now the strategies, and for each one, the position and the risk.
- Managed futures funds trade futures, often following trends, so a sudden reversal hurts them.
- Global macro funds take leveraged views on interest rates, currencies and commodities, and a wrong call is costly.
- Emerging market funds are mostly long, because shorting is hard in those markets, and they face sovereign risk and currency risk.
- Fixed income arbitrage takes small relative-value bets between bonds with heavy leverage, so the danger is spreads widening and liquidity drying up.
- Convertible arbitrage buys convertible bonds and shorts stock, and the danger is that the hedge breaks down when credit spreads widen or liquidity dries up.
- We will count the shares in a moment.
- Not one of these is a riskless trade.

25 Strategies, part two

Strategy, position and main risk

Strategy	Position and main risk
Merger arbitrage	Long target; deal fails
Distressed securities	Troubled debt; further default
Dedicated short	Only shorts; rising markets
Long-short equity	Both sides; picks go wrong

IN THE LESSON

- Four more.
- Merger arbitrage buys the target of a takeover and, in a share deal, often shorts the acquirer, and it loses heavily if the deal fails.
- Distressed securities funds buy the debt of troubled firms, hoping to profit from a recovery, and the risk is further default.
- Dedicated short funds only short, so they gain when prices fall and suffer when markets rise.
- Long-short equity funds hold both longs and shorts, so they can profit from picking winners and losers, and their risk is that the picks go wrong.
- The common mistake is calling arbitrage riskless.
- Merger arbitrage, convertible arbitrage and fixed income arbitrage all have a failure case, and leverage can make it severe.

26 Example 11: a convertible hedge

Illustration: each bond converts into 20 shares, delta 0.6

Shares on conversion	per bond	**20**
Shares to short	0.6 × 20 shares	**12 shares**
Position per bond	long bond, short stock	**short 12**
For 100 bonds	100 × 12 shares	**1,200 sold**
Small move in the stock	legs roughly offset	**stays hedged**

IN THE LESSON

- Let's count the shares in a convertible arbitrage trade.
- A convertible bond can be exchanged for company stock.
- Suppose each bond converts into twenty shares, and its delta, the sensitivity of the bond to the stock, is point six.
- The fund is long the bond, and to hedge the stock risk it shorts delta times the conversion shares.
- Point six times twenty is twelve shares per bond.
- So for each bond the position is long the bond, short twelve shares.
- For one hundred bonds, the fund shorts one hundred times twelve, which is twelve hundred shares.
- If the stock moves by a small amount, the gain on one leg roughly offsets the loss on the other, and the position stays hedged.

27 Example 12: merger arbitrage odds

Illustration: cash offer $50, target at $45, fails to $38

Gain if deal closes	50 − 45	**$5**
Loss if deal fails	45 − 38	**$7**
Spread earned	5 ÷ 45	**11.1%**
Break-even success chance	5p = 7(1 − p)	**58.3%**
Expected gain at 90% chance	0.9×5 − 0.1×7	**$3.80**

IN THE LESSON

- A takeover is announced: a bidder offers fifty dollars in cash for a target share, which now trades at forty-five dollars.
- If the deal closes, the arbitrageur who bought gains five dollars.
- If it fails, say the price falls back to thirty-eight dollars, the loss is seven dollars.
- The spread earned is five over forty-five, about eleven point one per cent.
- The break-even chance of success, p, solves p times five equals one minus p, times seven, so p is seven over twelve, fifty-eight point three per cent.
- At a ninety per cent chance of success, the expected gain is point nine times five, minus point one times seven, which is three dollars and eighty cents.
- Small gains, big losses.

28 How funds actually perform

- Mutual funds: about the market return before expenses
- Slightly below passive funds after expenses
- Little sign that past winners keep winning
- Hedge funds: varied, negative skew, fat tails
- Serial correlation: one month relates to the next

IN THE LESSON

- The last outcome is performance.
- Start with mutual funds.
- On average they earn roughly the market return before expenses, and slightly less than comparable passive funds after expenses.
- There is little evidence that past winners keep winning, so last year's top fund is not a reliable guide to next year's.
- Hedge fund returns are more varied.
- They often show negative skew, which means a long tail of large losses, fat tails, which means extreme outcomes more often than a normal curve suggests, and serial correlation, which means one month's return is related to the next.
- These features matter because the usual risk measures, like volatility, understate the danger when returns look like this.

29 Example 13: survivorship bias

Illustration: 10 funds start; 5 close after losses

Five survivors	8, 10, 12, 6, 14	**avg 10%**
Five closed funds	−6, −10, −4, −8, −2	**avg −6%**
Database shows survivors	average of the five	**10%**
Whole universe	(50 − 30) ÷ 10 funds	**2%**
Overstatement	10% − 2%	**8 points**

IN THE LESSON

- Reported hedge fund performance is also distorted by biases in the databases.
- The first is survivorship bias: funds that fail drop out, so the average of the survivors overstates what an investor in the whole universe earned.
- Say ten funds start and five close after losses.
- The five survivors returned eight, ten, twelve, six and fourteen per cent, an average of ten per cent.
- The five that closed returned minus six, minus ten, minus four, minus eight and minus two, an average of minus six.
- The database shows only the survivors, so ten per cent.
- The whole universe is the sum, fifty minus thirty, over ten funds, which is two per cent.
- The bias is eight percentage points.

30 The measurement biases

Each bias pushes measured performance up

Bias	What it does
Survivorship	Failed funds drop out
Backfill / incubation	Good early record added
Stale or smoothed prices	Low volatility, high Sharpe
Self-reporting	Only willing funds report
Net effect	All inflate performance

IN THE LESSON

- There are three more biases to know.
- Backfill or incubation bias arises when a fund is added to a database and its earlier record is filled in.
- Funds usually join after a good run, and poor early records are never listed, so the history looks better than the true experience.
- Smoothed or stale valuations of illiquid assets understate volatility and correlation, and so overstate the Sharpe ratio, which is excess return divided by volatility.
- Self-reporting adds selection bias, because funds choose whether to report, and those with good numbers are more willing.
- The point to remember is that every bias inflates measured performance, and in a scenario you should be able to say which bias is being described.

31 Example 14: smoothing flatters the Sharpe ratio

Illustration: return 8%, risk-free 2%

Excess return	8% − 2%	**6%**
True volatility	what market prices show	**10%**
Reported (smoothed) vol	stale prices hide swings	**6%**
True Sharpe ratio	6 ÷ 10	**0.60**
Reported Sharpe ratio	6 ÷ 6	**1.00**

IN THE LESSON

- Now see how smoothed valuations flatter the Sharpe ratio.
- Suppose a fund of illiquid assets returned eight per cent and the risk-free rate is two per cent, so the excess return is six per cent.
- Its true volatility, what market prices would show, is ten per cent.
- But because the assets are valued with stale, smoothed prices, the reported volatility is only six per cent.
- The true Sharpe ratio is six divided by ten, point six.
- The reported Sharpe ratio is six divided by six, one point zero.
- The return did not change at all.
- Only the measured risk shrank, so an investor would think the fund is far better than it is.

32 Four mistakes to avoid

- ETF has redemption by participants; closed-end has none
- Late trading breaks cut-off; timing uses stale prices
- Fee only above high-water mark; check hurdle, clawback
- Arbitrage is not riskless: size the failure case

IN THE LESSON

- Mistake one: treating an E T F like a closed-end fund.
- A closed-end fund has no redemption, but an E T F has creation and redemption by authorized participants, and that arbitrage holds price near N A V.
- Mistake two: mixing up the two bad behaviors.
- Late trading breaks the cut-off, while market timing exploits stale prices.
- Mistake three: charging the incentive fee on the whole gain in a year that only recovers earlier losses, which ignores the high-water mark.
- Check the hurdle and the clawback too.
- Mistake four: calling arbitrage riskless.
- Each arbitrage strategy has a failure case, and leverage can make it severe.

33 Recap: the main ideas

- Open-end: next NAV. Closed-end: market. ETF: arbitrage
- Late trading: cut-off. Timing: stale prices
- Hedge funds: private, light rules, lock-ups, 2 and 20
- Net = (gross − mgmt fee) × (1 − incentive rate)
- Hurdle, high-water mark, clawback; biases inflate

IN THE LESSON

- Let's pull it together.
- Open-end funds deal with the fund at the next N A V, adjusted for loads.
- Closed-end funds trade between investors at a premium or discount.
- E T Fs trade all day, and creation and redemption keeps price near N A V.
- Late trading breaks the cut-off, and market timing exploits stale prices.
- Hedge funds differ from mutual funds in investors, rules, freedom, liquidity terms and fees.
- The net return is the gross return minus the management fee, times one minus the incentive rate, with hurdles, a high-water mark and a clawback shaping the fee.
- Nine strategies each pair a position with a risk, and every database bias inflates the numbers.

34 Try three quick questions

1. Assets $330m, liabilities $30m, 15m shares. NAV per share?
   Answer: (330 − 30) ÷ 15 = $20.00.
2. Gross 20%, 2 and 20, no hurdle. Net return?
   Answer: (20% − 2%) × 0.8 = 14.4%.
3. Order at 5 pm filled at the 4 pm NAV. Which behavior; legal?
   Answer: Late trading. It breaks the cut-off; illegal.

IN THE LESSON

- Now try three quick questions yourself.
- Pause after each one.
- Question one.
- A fund has assets of three hundred and thirty million dollars, liabilities of thirty million, and fifteen million shares.
- What is its net asset value per share?
- Question two.
- A hedge fund charges two and twenty, with no hurdle.
- Its gross return is twenty per cent.
- What is the investor's net return?
- Question three.
- A fund accepts an order at five in the afternoon and fills it at the four o'clock net asset value.
- Which undesirable behavior is this, and is it legal?
- The answers are on the board.
- Check yours against them, and work back through the examples if any step felt unclear.